Effect of meal feed and coarser grinding of pelleted feed on productivity, microbiology, and physico-chemical properties in the gastro-intestinal tract of finishers

Christian Fink Hansen[1], Knud Erik Bach Knudsen[2], Bent Borg Jensen[2] & Helle D. Kjærsgaard[3]

1: The National Committee for Pig Production and The Royal Veterinary and Agricultural University, The Department for Nutrition and Reproduction, Axeltorv 3, 1609 Copenhagen V, Denmark, Phone: +45 3373 2711, Fax: +45 3314 2517, E-mail: CFH@danishmeat.dk 2: Department of Animal Nutrition and Physiology, Danish Institute of Agricultural Sciences, Research Centre Foulum, PO Box 50, DK-8830 Tjele, Denmark. 3: The National Committee for Pig Production

Summary: The effects of meal feed and coarser grinding of pelleted feed on the gastro-intestinal health and productivity of finishers were studied. The study comprised a total of 1.044 pigs and was designed as a randomised block test with six test groups and 17 replicates. Several tests have shown that meal feed may reduce Salmonella prevalence in infected herds. This test shows that very coarsely ground pellets and a diet in which the grain part consisted of barley and very coarsely ground wheat (1:1) and added formic acid resulted in the same changes in the physico-chemical properties as did meal feed. In particular the feed added formic acid affected the microbial composition in the gastro-intestinal tract as did meal feed. It is assumed that these two diets will also be able to reduce Salmonella prevalence in finishers without reducing the production value in the same way as meal feed.

Keywords: Feed, gastro-intestinal health, production value.

Introduction: Several epidemiological studies and controlled tests show that feed is a significant factor in reducing *Salmonella* at herd level. However, several questions on feed and additives need to be answered before it is possible to provide optimal advice in herds with Salmonella problems. This investigation examined if a coarsely ground, pelleted diet was level with meal feed regarding its effects on Salmonella and the microbial system in the gastro-intestinal tract, and examined the importance to the production economy.

Materials & methods: The investigation was carried out in one herd as a randomised block test with six test groups (table 1) and 17 replicates comprised a total of 1.044 pigs. The herd had a Salmonella problem at the beginning of the test. Within a block, the distribution by sex and the average weight on transfer were the same. The finisher units had fully slatted floors, and the pens were evenly distributed on each side of an inspection alley. The pigs were fed dry feed ad

libitum. Each housing unit had two sections, and there were a total of six sections in the test. Four of the sections had one dry feed single animal feeder and one nipple drinker per pen. Two of the sections had one simple dry feeder with four "eating stalls" and one nipple drinker per pen. The pigs were feed ad libitum. The feed was weighed out manually 1-2 times a day.

Table 1. Groups

Group	1	2	3	4	5	6
Diet	Wheat based	Control Wheat based	Wheat based	Wheat based	Wheat based	wheat/ barley (1:1) + 0.6% formic acid
Form	meal	pellets	pellets	pellets	pellets	pellets
Grinding	3.0 mm hammermill	2.0 mm hammermill	5.0 mm hammermill	Rollermill Medium coarse	Rollermill All coarse	Barley: 3.0 mm hammermill wheat: rollermill all coarse

The feed in all groups but group 1 was heat-treated at min. 81°C and pelleted. Feed intake, weight gain, disease treatments and slaughter data were registered. The production value per place unit was calculated on the basis of the production results. Immediately before delivery to slaughter, six pigs/pen were blood sampled and analysed for antibodies against *Salmonella* (Danish MIX-ELISA). The microbial composition of the pigs' gastro-intestinal tracts was examined in 17 pigs/group. Samples of the contents of the stomach and caecum were analysed for concentration of organic acids, pH, dry matter (DM), population of coliform bacteria, lactose negative enterobacteria, lactic acid bacteria, lactobacilli, enterococci and yeast. The degree of changes in the white part of the stomach was registered in approx. 370 pigs. Samples from the stomach and the small intestine were analysed for physico-chemical properties: viscosity, water binding capacity (WBC), and sedimentation by gravity. Data were subjected to an analysis of variance in the GLM procedure in SAS. The effect on Salmonella prevalence was assessed as the number of blood sampled pigs with an OD% above 20. Significant differences are stated at 5 percent level adjusted for five comparisons in pairs (groups 1, 3, 4, 5 and 6 with group 2) at a Bonferroni t-test.

Results: Unfortunately, the test contained too few Salmonella-positive pigs to be able to perform a statistical computation. The production results are listed in table 2. The production value was significantly lower for the pigs given meal feed compared to the pigs given pelleted feed. This was due to a lower gain and poorer feed conversion. The poorer feed conversion was probably due to incomplete digestion of potentially available nutrient and a larger feed waste.

Table 2. Production results, 30-106 kg

Group	1	2	3	4	5	6
Production value[1]						
GM/place unit/year, EUR	79*	106	106	101	99	111
Index	75	100	100	95	93	105

[1] Values marked * are significantly different from group 2 ($p<0.05$).

Significantly fewer stomach changes were found in groups 1, 5 and 6 compared to group 2. Furthermore, significantly less yeast was found in the stomachs and the caecums in group 6 compared to group 2. A significantly higher pH and fewer organic acids were found in the caecums in group 2 than in the other groups. The measurements of viscosity in the stomach and the small intestine showed no differences between the groups. The proportion of the gastric content present as solid material was significantly higher and there was less phase separation in groups 1, 5 and 6 compared to group 2.

Discussion and conclusion: This test shows that the feed's composition and processing introduce differences in the physico-chemical properties of the intestinal material, which in turn affects the microbial composition. Feeding with meal and coarse pellets instead of finely ground pelleted feed gives the intestinal material another texture expressed as minimal separation between the fluid and the solid phase. Digesta materials with little separation between the phases most likely influence the microbial composition and subsequently results in a higher concentration of organic acids. It is likely that lactic acid bacteria oust*Salmonella* in an environment with a high content of DM whereas *Salmonella* has an advantage in an aqueous environment. Other tests have shown that meal feed may reduce Salmonella prevalence in infected herds. This test shows that groups 5 and 6 resulted in the same changes in the physico-chemical properties as did meal feed. In particular the feed added formic acid affected the microbial composition in the gastro-intestinal tract as did meal feed. It is assumed that these two diets will also be able to reduce Salmonella prevalence in finishers without reducing the production value in the same way as meal feed.